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A CAUSAL ANALYSIS OF INTERRELATIONSHIPS AMONG EXERCISE, PHYSICAL FITNESS, AND WELL-BEING IN U.S. NAVY PERSONNEL[1]

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EXECUTIVE SUMMARY

Problem

The scientific literature reports that regular physical activity is beneficial in maintaining good physical and mental health. Specifically, it has been reported that regular activity and exercise decrease the risk of several chronic illnesses, notably cardiovascular diseases, and appear to increase longevity. The data on the psychological effects of physical fitness activities, though not conclusive, suggest that participation in conditioning programs can reduce anxiety and depression and increase general psychological well-being. However, the question remains as to whether these positive health outcomes are the direct result of the exercise itself or are related to physical fitness, only a part of which is a direct result of exercise.

Objective

The present research attempts to separate the effects of these two variables (physical fitness and exercise). In Part A of this report, exercise and several other variables are examined as predictors of physical fitness (defined as cardiorespiratory endurance and muscular endurance). In Part B, physical and psychological health outcomes (life satisfaction, perceived health, perceived fitness, symptoms of physical illness, psychological disturbance, depression, and self-esteem) are examined to assess the relative effects of exercise behavior and physical fitness in the prediction of these variables.

Approach

The relationships among physical fitness, exercise, and health outcomes were examined among 4,272 U.S. Navy personnel who completed a physical fitness test, Wallston and Wallston's Multidimensional Health Locus of Control Scale (MHLOC), eight items tapping health values, five dimensions of health care behaviors, and seven measures of mental and physical health outcomes.

Results

Regression analyses indicated that physical fitness, among both males and females, was predicted first by the combination of Internal Health Locus of Control and high Health Values and second by exercise. Among women, physical fitness tended to be the better predictor of both psychological and physical health. In contrast, among males fitness was the better predictor only of perceived health, while exercise was superior in predicting the more

psychological outcomes of heightened self-esteem and life satisfaction, fitness satisfaction, and lowered depression.

While exercise did not have a strong direct effect on well-being among females, it did have an indirect influence through physical fitness. Among males, however, exercise directly influenced physical fitness as well as the health-related outcomes of life satisfaction, perceived fitness, esteem, and depression. For both men and women, the better predictor of perceived fitness was frequency of exercising, not actual physical fitness.

Conclusions

The results of this study add to the growing literature demonstrating the favorable effects of exercise and fitness on physical and psychological health. In spite of the great popularity of exercise programs, physical fitness and not exercise per se appears to be the more important influence on physical and psychological health outcomes among females, while the results are mixed for males. Through its effect on physical fitness, exercise indirectly leads to well-being in both women and men.

A CAUSAL ANALYSIS OF INTERRELATIONSHIPS AMONG EXERCISE, PHYSICAL FITNESS, AND WELL-BEING IN U.S. NAVY PERSONNEL

Although many companies are investing large amounts of money in fitness programs, the value of such programs has yet to be established (Falkenberg, 1987). These investments are being made on the basis of very limited research and extensive untested beliefs and assumptions about the relationship among exercise, fitness, and health (Cox, Gotts, Boot, & Kerr, 1988).

The term "physical fitness" itself is problematic because it is defined in different ways. The World Health Organization defined fitness as the ability to perform muscular work satisfactorily (Andersen, Shephard, Denolin, Varnauskas, & Masironi, 1971). More recently, researchers have identified two distinct kinds of physical fitness: skills-related or motor fitness, which pertains to athletic ability, and health-related fitness, which pertains to physical well-being (Caspersen, Powell, & Christenson, 1985; Pate, 1983). Those researchers have suggested that there are five basic components of health-related physical fitness: cardiorespiratory endurance, muscular strength, muscular endurance, body composition, and flexibility.

However, the lay public's understanding and everyday usage of the term "physical fitness" is rather different from these technical definitions. For most people, level of regular exercise is a major component of their concept of physical fitness; thus, it has been suggested that the measurement of the level of regular exercise (i.e., frequency, intensity) be included in any physical fitness appraisal (Hopkins & Walker, 1988). Even in the more scientific literature, some researchers have used the term "fitness program" when they really are referring to a physical exercise program.

The scientific literature reports that regular physical activity is beneficial in maintaining good physical and mental health. Specifically, it has been reported that regular activity and exercise decrease the risk of several chronic illnesses (Siscovick, LaPorte, & Newman, 1985), notably cardiovascular diseases (Powell, Thompson, Caspersen, & Kendrick, 1987), and appear to increase longevity (Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1989; Paffenbarger, Hyde, Wing, & Hsien, 1986). The data on the psychological effects of physical fitness activities, though not conclusive, suggest (Folkins & Sime, 1981) that participation in conditioning programs can reduce anxiety and

depression (Blumenthal, Williams, Needels, & Wallace, 1982; Folkins, 1976; Folkins, Lynch, & Gardner, 1972; Lichtman & Poser, 1982; Morsan, Roberts, Brand, & Freinerman, 1980) and increase general psychological well-being (Goldwater & Collis, 1985). However, one question remains unanswered: are these positive health outcomes the direct result of the exercise itself or are they related to physical fitness, only a part of which is a direct result of exercise?

The present research is an attempt to separate these two variables (physical fitness and exercise). Specifically, in Part A, exercise is one of five health behaviors examined (the other four being eating habits, rest and sleep practices, substance use, and preventive health behaviors). The effects of these health practices on physical fitness (defined by cardiorespiratory endurance and muscular endurance) and exercise will be explored. In addition, the role of health locus of control and health values in determining physical fitness and exercise negligence will be examined. In Part B, physical and psychological health outcomes (life satisfaction, perceived health, perceived fitness, symptoms of physical illness, psychological disturbance, depression, and self-esteem) will be examined to assess the relative merits of exercise behavior and physical fitness in the prediction of these mental and physical health-related consequences.

Method

Sample

A physical fitness test and a questionnaire tapping health attitudes and behaviors were completed by 4,272 active-duty members of the U.S. Navy. This assessment was made during part of a 3-year Navywide longitudinal evaluation of factors related to health and physical readiness begun in 1986 (Conway, Trent, & Conway, 1989). The sample was 87% male (N=3,717) and 13% female (N=555). The mean age of the males was 29.6 years (S.D.=7.4). Ninety-eight percent of the males completed 12 or more years of education, and 64% were married. The mean age of the females was 28.4 years (S.D.=6.1); 100% had completed 12 or more years of education, and 39% were married. Among the males, 86% were enlisted while 80% of the females were enlisted.

Physical Fitness

The Physical Readiness Test (PRT) is required biannually as part of the Navy's Health and Physical Readiness Program (Chief of Naval Operations, 1986). The PRT includes the following components:

(1) time to run/walk 1.5 miles or time to swim 500 yards (taps stamina and cardiorespiratory endurance);

(2) number of bent-knee sit-ups completed in a 2-minute period (tests muscular endurance); and

(3) number of push-ups completed in a 2-minute period (taps muscular endurance).

These scores are combined into an overall measure of physical fitness by using the Navy's PRT point chart (Chief of Naval Operations, 1986). Points are assigned to raw scores on each of the fitness tests (run, sit-ups, push-ups), then added together for an overall score. The range of total points possible is 0-300. Points can be adjusted for age and sex into five classification categories (ranging from Outstanding to Fail). However, because of the greater variance and discrimination afforded by total points (versus classification category), the present analyses employed total points as the fitness measure, and analyses were performed separately for men and women.

Health Locus of Control x Values

Participants completed the Multidimensional Health Locus of Control Scale (MHLOC; Wallston & Wallston, 1981) which yields three scores: Internal (IHLOC), Powerful Others (PHLOC), and Chance Control (CHLOC). According to the locus of control theory, individuals with an internal health locus of control orientation believe that they can control many aspects of their health through their own behavior. Persons with a chance orientation believe that the control of their health lies with luck, fate, or chance and that there is little they can do to affect it. Those with a powerful-others orientation believe that health professionals control health and that regular contact with them and adherence to their advice is the best way to stay healthy. Cronbach alphas for these scales ranged from .64 (IHLOC for females) to .72 (PHLOC for males).

Respondents also completed eight items related to health values (e.g., "How important is it for you to have good health?") (cf., Conway, 1989). In the present study, the eight items were averaged to form a single scale; the internal consistency (alpha coefficient) for the 8-item Health Value scale in the current sample was .86.

Since Wallston and Wallston (1981) have postulated that health locus of control orientation should predict health behaviors only under high health-value conditions, the interaction of health orientation and health values was the

cognitive measure included in this study. The interaction or joint score is the product of the MHLOC subscale score multiplied by the health value scale.

Health Behaviors

Five dimensions of health care behaviors were tapped. These have all been worded in a negative direction to remain compatible with other health behavior scales (i.e., Self Care Inventory, Pardine, Fricke, Dytell, & Napoli, 1989) and, thus, reflect negligent health behaviors including: (a) Poor eating habits (22 items, such as skipping meals or eating the wrong kinds of food, alpha=.58 and .69 for males and females, respectively); (b) Exercise negligence (13 items tapping frequency of activities, such as swimming, walking, calisthenics, weight lifting, "working up a good sweat," etc., alpha=.71 and .62); (c) Poor rest and sleep behaviors (3 items including relaxation behaviors and number of hours of sleep, alpha=.55 and .57); (d) Substance use (8 items tapping alcohol, caffeine, and tobacco use, alpha=.58 for both males and females); and (e) Lack of preventive health behaviors (10 items such as receiving regular medical checkups and using dental floss regularly, alpha=.64 and .61). The higher the score on the behavioral scales, the greater the negligence.

Well-Being Measures

Seven outcome measures were included. The first was an overall life satisfaction scale consisting of three items (see Appendix) from Andrews and Withey (1976); the internal consistency in this sample as assessed by Cronbach's alpha was .88. The second was a self-evaluation of current health status consisting of two items (see Appendix) with an alpha of .79. The third was a self-evaluation of fitness consisting of two items (see Appendix) with an alpha of .75. The higher the number on these three measures, the greater the satisfaction with life or health or fitness status. The fourth measure was a physical symptoms checklist where respondents reported the frequency with which they experienced 39 physical symptoms (e.g., cough, constipation, back problems) utilizing 6-point Likert scales. The higher the number, the more physical illness symptoms were experienced; Cronbach's alpha for this sample was .92. The fifth and sixth measures were: (a) a 7-item psychological disturbance scale adapted from Langner (1962), with a reliability of .78 on the current sample, and (b) a 4-item depression scale adapted from the adjective checklist (Gough & Heilbrun, 1975), with an internal consistency for this sample of .86. Both of these measures were scored so that higher scores reflected greater psychological

disturbance. The seventh measure, the 10-item Rosenberg Self Esteem Scale (1965) was scored in the direction of higher esteem; its internal consistency as assessed by Cronbach's alpha was .85 in this sample.

Results

Means and standard deviations for all measures are presented in Table 1. A number of sex differences were found. Among the health locus of control variables, males were significantly higher on the interaction of PHLOC and health

Table 1

Means, Standard Deviations, and t-Tests for Navy Men and Women

	Males (N=1766)		Females (N=275)		
	Mean	S.D.	Mean	S.D.	t
Predictor Variables:					
IHLOC*Values	812.401	254.218	817.336	240.792	- .35
CHLOC*Values	477.610	176.269	493.313	179.561	-1.60
PHLOC*Values	522.650	205.677	495.581	187.088	2.39**
Substance Use	14.070	10.352	8.705	7.059	9.78***
Prevention Negligence	12.017	4.515	11.122	4.372	3.50***
Poor Rest/Sleep	13.479	2.335	13.489	2.454	- .08
Poor Eating Habits	59.080	8.966	56.997	9.440	4.03***
Exercise Negligence	71.420	9.094	73.038	7.429	-1.96*
Fitness Test (points)	206.586	38.654	169.037	37.892	18.26***
Health Outcome Variables:					
Illness Symptoms	13.132	13.724	16.606	16.002	-4.30***
Self Esteem	60.189	8.770	58.021	9.817	4.70***
Life Satisfaction	15.622	3.288	15.057	3.440	3.13**
Health Satisfaction	7.533	1.662	7.500	1.863	.36
Fitness Satisfaction	6.579	1.673	6.062	1.888	5.61***
Illness Symptoms	13.132	13.724	16.606	16.002	4.30***
Psych. Disturbance	4.825	3.750	5.586	4.291	-2.80**
Depression	2.612	1.380	2.948	1.494	-4.39***

* p<.05 ** p<.01 *** p<.001

values. Among the measures of health care behavior, males were significantly higher on substance use, lack of preventive health behaviors, and negligent

eating habits, while females were higher on negligence in the area of exercise. Significant sex differences also emerged on the health-related measures, with females having more negative outcomes. Females were higher than males on reported symptoms of physical illness, psychological disturbance, and depression, while they were lower than males on self-esteem, life satisfaction, and perceived fitness.

A. Predictors of Physical Fitness and Exercise

In order to examine the predictors of physical fitness and exercise behavior, stepwise regression analyses were computed separately for males and females. The three cross-product terms of health locus of control orientations multiplied by health values and the five health care behavior variables were used as predictors of the fitness and exercise measures. The results of these analyses are summarized in Table 2. The significant predictors of physical

Table 2

Behavioral and Cognitive Determinants of Physical Fitness and Exercise Among Men and Women

Dependent Variable = Fitness			Dependent Variable = Exercise		
Males					
	Beta	Variance		Beta	Variance
1. IHLOC*Values	.3043	.1793****	1. IHLOC*Values	-.4187	.2432***
2. Exercise	-.2278	.0377****	2. Eating Habits	.1292	.0216****
			3. Prevention	.1214	.0098**
Constant=239.8138	R=.4658	R2=.2170	4. Substance Use	-.0894	.0077**
			Constant=73.7092	R=.5313	R2=.2822
Females					
	Beta	Variance		Beta	Variance
1. IHLOC*Values	.3577	.2316****	1.IHLOC*Values	-.4717	.2225****
2. Exercise	-.2714	.0584*			
			Constant=84.2189	R=.2189	R2=.2225
Constant=236.5727	R=.5385	R2=.2899			

* p<.05 ** p<.01 *** p<.001 **** p<.0001

fitness were identical for males and females. For both, the combination of IHLOC and high health values entered in the first step and determined the largest proportion of fitness variance while exercise negligence entered second. A slightly larger proportion of fitness variance was accounted for in females (29%) than in males (22%).

Predicting the exercise negligence variable among males, 28% of the variance was accounted for by the following four variables: (a) the combination of high internal locus of control and high health values, (b) poor eating habits, (c) inadequate prevention behaviors, and (d) substance use. However, in the smaller female sample only one significant variable emerged--the interaction of high internality and high health values--and it accounted for 22% of the variance in exercise.

B. Effects on Well-Being

Is physical fitness a predictor of mental and physical health-related consequences? This question was examined in a series of forced-entry regression analyses summarized in Table 3. The dependent variables were depression, psychological disturbance, symptoms of physical illness, self-esteem, and satisfaction with one's life, one's health, and one's fitness. Physical fitness was the independent variable forced to enter the regression to produce an equation describing the predictive relationship (even if nonsignificant) between physical fitness and the dependent measures. The findings from these regression analyses indicated that physical fitness accounted for significant proportions of variance in heightened self-esteem and satisfaction with health, and lowered physical illness, psychological disturbance, and depression. An interesting sex difference appeared. Among females, as compared with males, greater proportions of variance in physical illness symptoms (4.1% and .5% for females and males, respectively), perceived health (13.1% compared to 6.8%), perceived fitness (18.7% compared to 13.0%), and psychological disturbance (7.4% compared to .8%) were accounted for by physical fitness. Thus, fitness was a better predictor of all measures of psychological and physical health for females than for males.

Is exercise a predictor of well-being? This question was examined in a series of forced entry regression analyses with the same dependent variables as above; the results are summarized in Table 4. Among males, negligence in

Table 3

Fitness Test Performance (Points) as a Predictor of Well-being among Men and Women

	Males (N=1766)		Females (N=275)	
Dependent Variable	Beta	Variance[a]	Beta	Variance[a]
Self Esteem	.0568	.0032*	.0616	.0038
Life Satisfaction	-.0298	.0009	.0332	.0011
Perceived Health	.2612	.0682****	.3612	.1305****
Perceived Fitness	.3602	.1298****	.4329	.1874****
Illness Symptoms	-.0687	.0047**	-.2019	.0408***
Psych. Disturbance	-.0908	.0083**	-.2711	.0735***
Depression	-.0066	.0000	-.0651	.0042

[a] Total variance accounted for as indicated by regression R-squared.

* p<.05 ** p<.01 *** p<.001 **** p<.0001

exercising accounted for significant proportions of variance in lowered self-esteem (1.7%), life satisfaction (1.2%), perceived health (6.5%), perceived fitness (15.8%), and heightened depression (1.0%). However, due to differences in sample size, exercise played a more limited role among females, where the only significant proportion of variance accounted for by exercise negligence was on perceived health (7.1%) and perceived fitness (27.7%). Thus, physical fitness and not exercise is the better predictor of health-related outcomes in females. For males the picture is mixed; fitness is the better predictor of physical symptoms (accounting for .5% of the variance) and psychological disturbance (.8%), while exercise negligence accounts for a greater proportion of variance in self esteem (1.7%), fitness satisfaction (15.8%), life satisfaction (1.2%) and depression (.9%).

What are the interrelations among these variables when exercise, fitness, and well-being are considered simultaneously? For most people the implicit

Table 4

Exercise as a Predictor of Well-being Among Men and Women

	Males (N=950)		Females (N=133)	
Dependent Variable	Beta	Variance[a]	Beta	Variance[a]
Self Esteem	-.1293	.0167****	.0416	.0017
Life Satisfaction	-.1094	.0120***	-.0505	.0026
Perceived Health	-.254[illegible]	.0647****	-.2661	.0708**
Perceived Fitness	-.3969	.1575****	-.5263	.2770****
Illness Symptoms	-.0227	.0005	.0163	.0003
Psych. Disturbance	.0559	.0031	.1492	.0223
Depression	.0936	.0088**	.1349	.0182

[a] Total variance accounted for as indicated by regression R-squared.

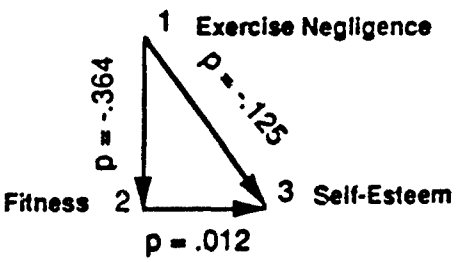
* p<.05 ** p<.01 *** px.001 **** p<.0001

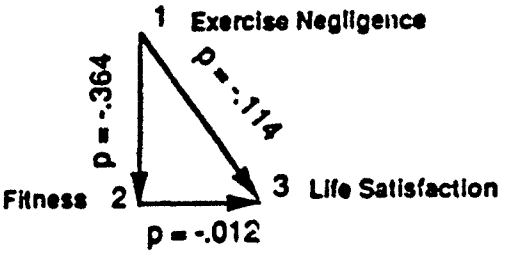
assumption is that engaging in exercise will increase fitness, which in turn will lead to better health. This assumption was tested using a series of path analyses for a simple recursive three-variable model (Asher, 1983; Kerlinger & Pedazur, 1973). In this three-variable model, the path coefficients express the direct causal effect of one variable on the other; that is, the effect of exercise negligence on both physical fitness and well-being as well as the effect of physical fitness on well-being (see Figures 1 & 2).

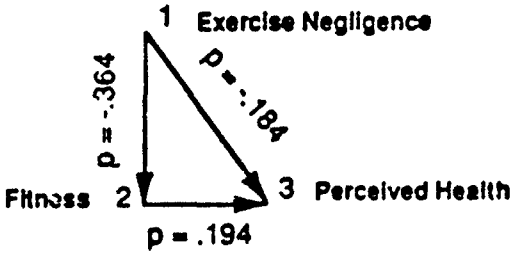
The direct effect of exercise on a given health-related outcome measure is equal to the path coefficient between exercise negligence (1) and the health-related outcome (3). The indirect effects (compound paths) of exercising on a

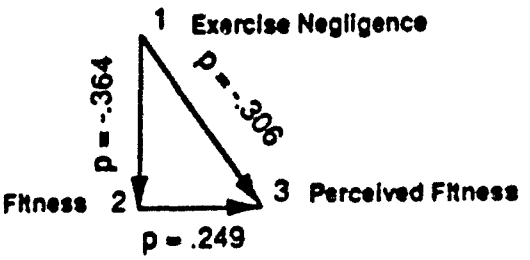
Figure 1.

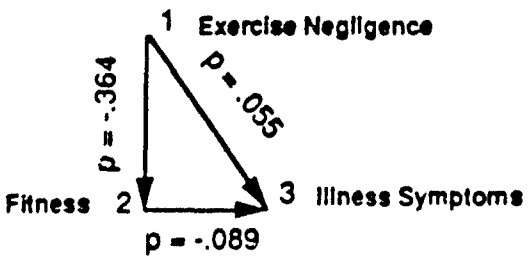
Path Diagrams for the Prediction of Health Outcomes (3) from Exercise Negligence (1) and Fitness (2) Among Males.

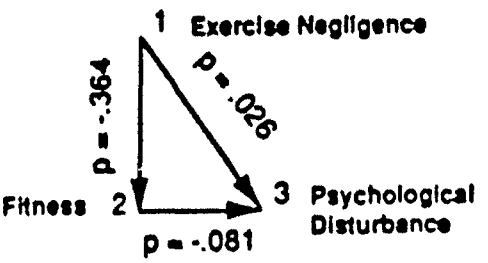












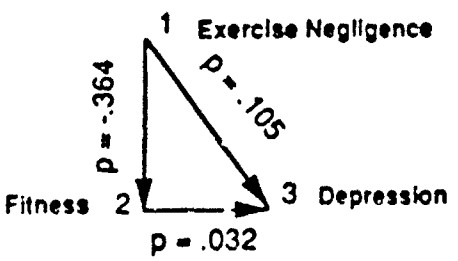
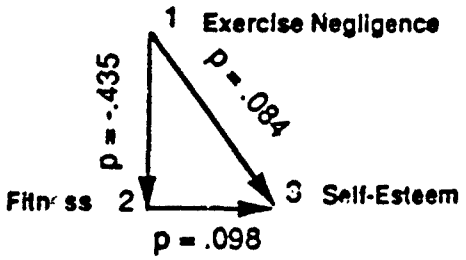
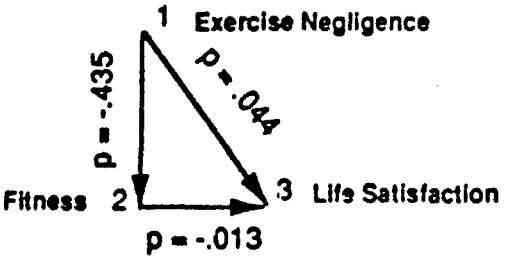
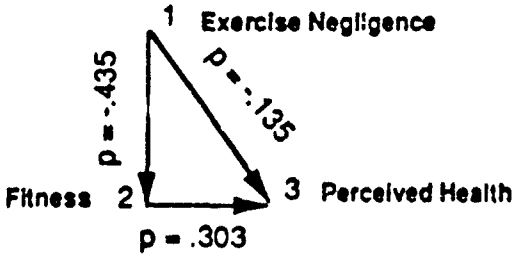


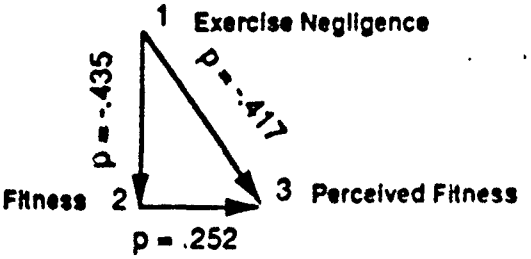
Figure 2.

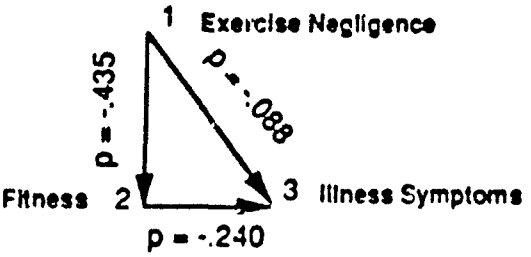
Path Diagrams for the Prediction of Health Outcomes (3) from Exercise Negligence (1) and Fitness (2) Among Females.

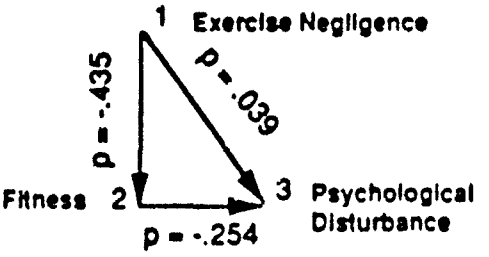


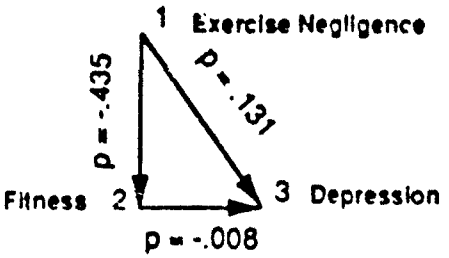












given outcome measure are calculated by multiplying the two direct effects of the other variables involved; that is, the path coefficient between exercise negligence (1) and fitness (2) is multiplied by the coefficient between fitness (2) and a given health-related outcome (3). Among males (see Table 5), the direct effect on psychological disturbance of negligence in exercising (.026) was less than the direct effect of physical fitness (-.081) on that outcome. The direct effect on illness symptoms of exercise negligence (-.055) was less than the direct effect of physical fitness (-.089). The direct effect on perceived health of exercise negligence (-.184) was approximately equal to the direct effect of physical fitness on that outcome. On the remaining outcome measures, however, the direct effects of exercise negligence were larger than the direct effects of physical fitness. These direct effects of exercise do not take into account the indirect effects of exercise through physical fitness; thus, exercise negligence had a greater total effect in determining well-being than did physical fitness.

Among females (see Table 6), the direct effects of exercise negligence were greater than the direct effects of physical fitness on life satisfaction (.044 and -.013 respectively), on perceived fitness (-.417 and .252) and on depression (.131 and -.008). On self-esteem, the direct effects of exercise negligence (.084) and physical fitness (.098) were similar. However, on three outcomes--perceived health (-.135 and .303), illness symptoms (-0.088 and -.240), and psychological disturbance (.039 and -.254)--physical fitness exerted a greater direct effect than did exercise negligence. Thus, physical fitness status appeared to have a greater effect on females than males. Among women, increased exercise led to increased physical fitness, which in turn led to a decrease in physical illness symptomatology and psychological disturbance and an increase in health satisfaction. Thus, the effects on physical illness, psychological disturbance, and health satisfaction were mediated by physical fitness. Among males however, the indirect effects were smaller. With the exception of the psychological disturbance measure, the indirect effects of exercise negligence were smaller than direct effects. Thus, in males the influence of exercise negligence on health tended to be more direct and less mediated by physical fitness.

Table 5

Direct and Indirect Effects of Exercise Negligence on Well-Being Among Males

Outcome	Direct Effect	Indirect Effect	Total Effect
Self Esteem			
Exercise Negligence	-.125	-.004	-.129***
Physical Fitness	.012		.012
Life Satisfaction			
Exercise Negligence	-.114	-.004	-.118***
Physical Fitness	-.012		-.012
Perceived Health			
Exercise Negligence	-.184	-.071	-.255***
Physical Fitness	.194		.194
Perceived Fitness			
Exercise Negligence	-.306	-.091	-.397****
Physical Fitness	.249		.249
Illness Symptoms			
Exercise Negligence	-.055	-.032	-.023
Physical Fitness	-.089		-.089
Psychological Disturbance			
Exercise Negligence	.026	.029	.055
Physical Fitness	-.081		-.081
Depression			
Exercise Negligence	.105	-.012	.093**
Physical Fitness	.032		.032

* p<.05 ** p<.01 *** p<.001 **** p<.0001

Discussion

The increasing interest in physical exercise programs over recent years reflects, in part, the conviction that physical fitness will develop from participation in these programs, and that fitness has psychological as well as

Table 6
Direct and Indirect Effects of Exercise Negligence on Well-Being Among Females

Outcome	Direct Effect	Indirect Effect	Total Effect
Self Esteem			
Exercise Negligence	.084	-.043	.041
Physical Fitness	.098		.098
Life Satisfaction			
Exercise Negligence	.044	.006	.050
Physical Fitness	-.013		-.013
Perceived Health			
Exercise Negligence	-.135	-.132	-.267
Physical Fitness	.303		.303
Perceived Fitness			
Exercise Negligence	-.417	-.110	-.527
Physical Fitness	.252		.252
Illness Symptoms			
Exercise Negligence	-.088	-.104	-.016
Physical Fitness	-.240		-.240
Phychological Disturbance			
Exercise Negligence	.039	.110	.149
Physical Fitness	-.254		-.254
Depression			
Exercise Negligence	.131	.003	.134
Physical Fitness	-.008		-.008

* p<.05 ** p<.01 *** p<.001 **** p<.0001

physiological benefits. The results of this study add to the growing literature demonstrating the favorable effects of exercise and fitness on physical and psychological health.

The major focus of this study, however, was to differentiate between physical fitness and exercise and their effects on health outcomes. According to Hopkins and Walker (1988), the average person does not make this differentiation; instead, level of exercise is seen as the major component of a concept of

fitness. This means that individuals who exercise regularly perceive themselves as being fitter. Results of the present study confirm Hopkins' and Walker's observation. For both men and women, the better predictor of perceived fitness was frequency of exercising, not actual physical fitness. Those subjects who exercised more often perceived themselves as being physically fitter than those who exercised less frequently. This relationship was strongest among women, where 28% of fitness status self-evaluation was determined by frequency of exercising.

In terms of differentiating between physical fitness and exercise negligence on the basis of their effects on other health outcomes, physical fitness tended to be the better predictor of both psychological and physical health among women while exercise negligence tended to be the stronger predictor for men. This sex difference is consistent with Jasnoski, Holmes, and Bank's (1988) finding that aerobic fitness was associated with positive psychological effects for women but not men. The possibility exists that females are more sensitive about their bodies and the cosmetic appearance of their bodies; thus, higher levels of fitness may have greater psychological payoffs for females. However, physical fitness contributes physiologically to the health of both males and females. Among males in the current study, fitness appeared to be the best predictor of perceived health, while exercise was superior in predicting the more psychological outcomes of heightened self-esteem and life satisfaction, fitness satisfaction, and lowered depression.

One could argue that while physical fitness tended to have a greater effect on health outcomes than did exercise negligence among females and a weaker effect among males, the proportions of variance accounted for either by fitness or exercise considered separately as predictors of the well-being outcomes was limited, varying between a low of .3% for esteem in males to a high of 27.7% for fitness satisfaction in females. Two issues are pertinent here. Exercise and physical fitness are only two among numerous variables that may influence health outcomes. Since health is multidetermined, the impact of many self-care behaviors, health beliefs, and other variables must be examined simultaneously.

The second issue concerns the fitness status of the current sample. Navy personnel are required to pass this fitness test twice a year; thus, these individuals are probably fitter than the average civilian. It is possible that fitness would be a stronger variable and account for more variance in health

outcomes in a sample with a less restricted range of fitness and, consequently, greater variance in physical fitness and health. Further research on other samples with greater variability on physical fitness is recommended.

It has been suggested that physical activity and fitness have indirect as well as direct effects on health outcomes; that is, they may work through other health-related behaviors such as smoking or overeating (see Blair, Jacobs & Powell, 1985 for a review of the literature on the association of exercise with other health behaviors). The significant associations found in the present study for men between exercise behaviors and eating habits, prevention activities, and substance use support this notion of indirect pathways.

The order in which variables emerged in the examination of the predictors of both exercise and fitness is suggestive of multiple direct and indirect effects. An internal health orientation and high health values were the strongest determinants of both exercise behavior and physical fitness. From these analyses it appears that other health care behaviors were related to exercise behavior, and that exercise behavior was a determinant of physical fitness. Supporting this interpretation is Goldwater and Collis' (1985) experimental work which demonstrated that physical training leads to improved fitness, and fitness leads to increased psychological well-being.

Results from the path analyses identify the pathways through which exercise behaviors and physical fitness influence health outcomes. While exercise did not have a strong direct effect on well-being among females, it did have an indirect influence through physical fitness; thus, females who exercised more were both physically fitter and healthier. This is consistent with the Goldwater and Collis (1985) findings.

A different pattern emerged for males. Exercise directly influenced physical fitness as well as the health-related outcomes of life satisfaction, perceived fitness, esteem, and depression. Fitness influenced health satisfaction, psychological disturbance, and physical illness. However, somewhat surprisingly, fitness did not mediate the relationship between exercise and well-being as strongly for males as it did for females. This sex difference could be a real difference between males and females or it could be an artifact of the sampling. Further research with other samples is needed to clarify the direct and indirect paths through which these variables operate as well as the reasons behind these sex differences.

In conclusion, in spite of the great popularity of exercise programs, physical fitness and not exercise per se appears to be the more important influence on physical and psychological health outcomes among females, while the results are mixed for males. This does not mean that exercise activities are unimportant; rather, exercise does predict actual physical fitness as well as perceived physical fitness. Through its effect on physical fitness, exercise indirectly leads to well-being in both women and men.

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APPENDIX 1

Scales of Behavioral Negligence
(Total Scale - 56 Items)

Exercise Negligence

FREQUENCY OF EXERCISE

(i.e., how often per week or month do you exercise)
- Running
- Swimming
- Bicycling
- Racket sports
- Continuous walking for exercise
- Aerobic dance or aerobic exercise class
- Weight lifting
- Calisthenics
- Basketball
- Baseball/softball
- OTHER (Please specify)

In your exercise or leisure activities, how often do you "work up a good sweat?"

I exercise to stay healthy

Lack of Rest/Sleep

How many hours of sleep do you usually get per night?

I get enough sleep.

I choose my spare time activities to help me relax.

Poor Prevention Behaviors

Do you regularly participate in any of the following programs, activities, or clubs; or would you like to participate if they were more readily accessible?

- Gym or fitness center
- Command-organized sports
- Command exercise programs
- Blood pressure screening
- Cholesterol/blood fats testing

I see a doctor for regular checkups:

I watch for possible signs of major health problems (e.g., cancer, hypertension heart disease).

I see a dentist for regular checkups.

I take vitamins

I get shots to prevent illness.

Substance Use

During the past week, on the average how many cups of caffeinated coffee did you have per day?

During the past week, on the average how many cups or glasses of caffeinated tea did you have per day?

During the past week, on the average how many caffeinated cola or carbonated drinks did you have per day?

During the last 7 days, on how many days did you have any alcoholic beverages?

On the days you drank any alcoholic beverage this week, how many drinks did you usually have per day? (Consider a single shot, single mixed drink, glass of wine, or can of beer as one drink.)

During the past 12 months, how often on the average have you used chewing tobacco, snuff, or other smokeless tobacco?

During the past 12 months, how often on the average have you used chewing tobacco, snuff, or other smokeless tobacco?

Poor Eating Habits

During the last 7 days, how often did you ... ?

Eat breakfast
Eat lunch
Eat dinner
Eat snacks between meals
Overeat
Fast (not eat) an entire day

During the last 7 days, how often did you ...?

add salt to your food at the table
eat high-fat meat (e.g., hamburger, hot dogs, steak, bacon, bologna, sausage)
eat lean meats (e.g., chicken or turkey without the skin, veal)
eat fish (e.g., fresh ocean or lake fish, canned tuna, salmon)
eat high-fat dairy products (e.g., whole milk, cream, cheeses, ice cream)
eat low-fat dairy products (e.g., low-fat milk or cottage cheese, yogurt)
eat (or cook with) butter, lard, or saturated fats (e.g., fat on meat)
eat polyunsaturated fats or oils (e.g., soft margarines, vegetable oils, nuts)

eat fried foods (e.g., french fries, fried chicken, fried eggs)
eat refined sugar products (e.g., cakes, pies, cookies, candy)
eat "leafy" vegetables (e.g., broccoli, cauliflower, cabbage, greens)
eat "starchy" vegetables (e.g., beans, peas, corn, potatoes)
eat fruits (e.g., apples, oranges, dried fruits, raisins, melons, bananas)
eat high-fiber grains (e.g., whole wheat breads, oatmeal, bran cereals)

I eat a balanced diet.

I limit my intake of foods like coffee, sugar, fats, etc.

Perceived Health Scale

How would you rate your current health?

To what extent is your current health what you want it to be?

Perceived Fitness Scale

How would you rate your current physical fitness?

To what extent is your current physical fitness what you want it to be?

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The relationships among physical fitness, physical exercise, and health outcomes were examined among 4,272 U.S. Navy personnel who completed (1) a physical fitness test; (2) Wallston and Wallston's Multidimensional Health Locus of Control Scale (MHLOC); (3) eight items tapping health values; (4) five dimensions of health care behaviors; and (5) seven measures of mental and physical health outcomes. Regression analyses revealed that physical fitness was a better predictor than exercise of health outcomes among women. Fitness among both males and females was predicted first by the combination of Internal Health Locus of Control and high Health Values and second by exercise. It appears that certain health care behaviors (prevention activities, eating habits, substance use) are associated with exercise activities which, in turn, affect physical fitness. Fitness tends to mediate the relationship between exercise and well-being in females, while both exercise and fitness lead directly to positive health consequences in males.

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